

How predictable are European winters?

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Predicting the North Atlantic climate is a step closer following a major scientific breakthrough.

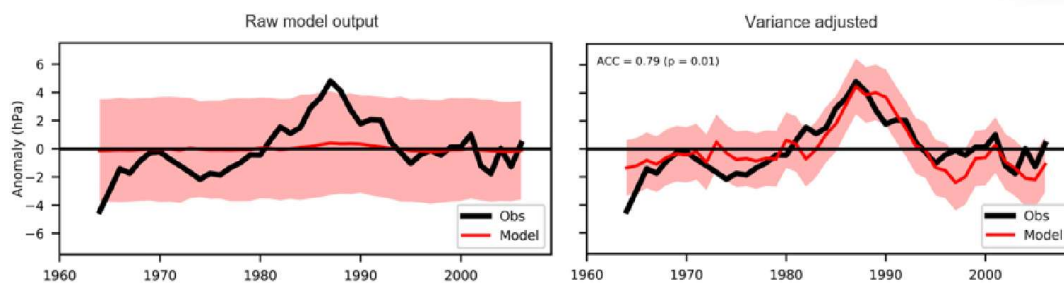
A team of scientists, led by the Met Office, has achieved a scientific breakthrough allowing the [longer-term prediction of North Atlantic pressure patterns](#), the key driving force behind winter weather in Europe and eastern North America.

Published in Nature, the study analysed six decades of climate [model](#) data and suggests decadal variations in North Atlantic atmospheric pressure patterns (known as the [North Atlantic Oscillation](#)) are highly predictable, enabling advanced warning of whether winters in the coming decade are likely to be stormy, warm and wet or calm, cold and dry.



North Atlantic climate far more predictable than models imply

North Atlantic Oscillation (NAO) : Forecast years 2 to 9



Taken at face value (left panel) models are unable to predict the NAO

But signal is 10 times too small and skill is potentially very high (right panel)

Need 100 times more ensemble members to extract the signal

Extends “signal-to-noise paradox” to decadal timescales

Smith et al 2020, Nature

However, the study revealed that this predictable signal is much smaller than it should be in current climate models. Hence 100 times more ensemble members are required to extract it, and additional steps are needed to balance the effects of winds and greenhouse gases. The team showed that, by taking these deficiencies into account, skilful predictions of extreme European winter decades are possible.

Lead author [Dr Doug Smith](#), who heads decadal climate prediction research and development at the Met Office Hadley Centre, said: “The message from this study is double-edged: climate is much more predictable than we previously thought, but there is a clear need to improve how models simulate regional changes.”

30 years
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Advance warning of severe winter weather is imperative to those who make risk-based decisions over longer timescales. For example, better forecasts can help the Environment Agency plan water management and flood defences, insurance companies plan for the changing risks, the energy sector to mitigate against potential blackouts and surges, and airports plan for potential disruption.

Improving model simulations will enhance the UK's response, resilience and security against the effects of extreme weather and climate change – influencing future policy decisions to protect people's lives, property and infrastructure.

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